Feb. 4, 1936. B. G. FLEMING 2,029,818

DOOR OPERATING MECHANISM

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Fig. 1.

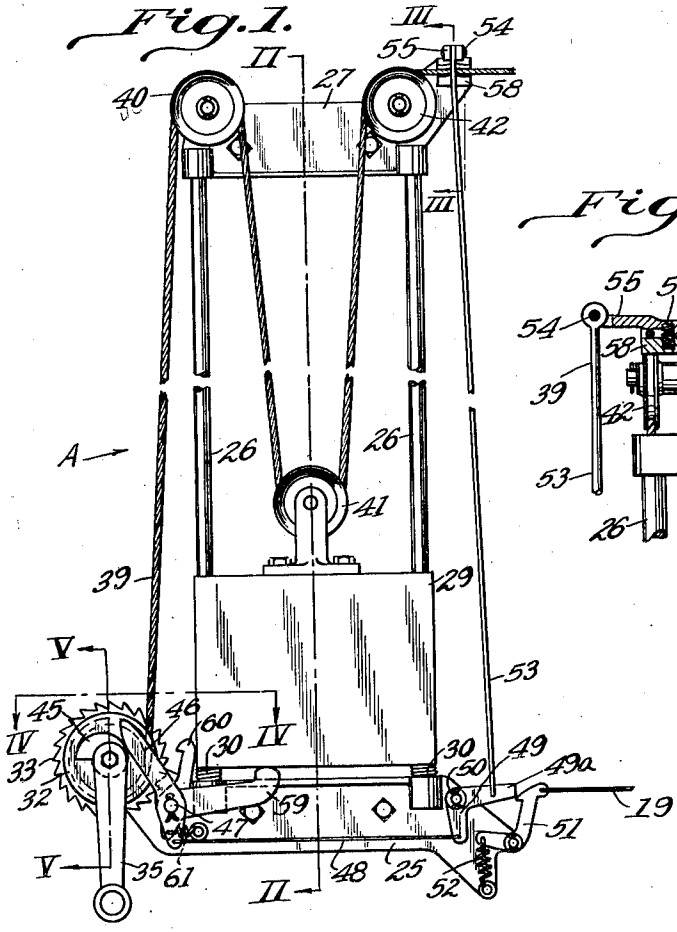


Fig. 2.

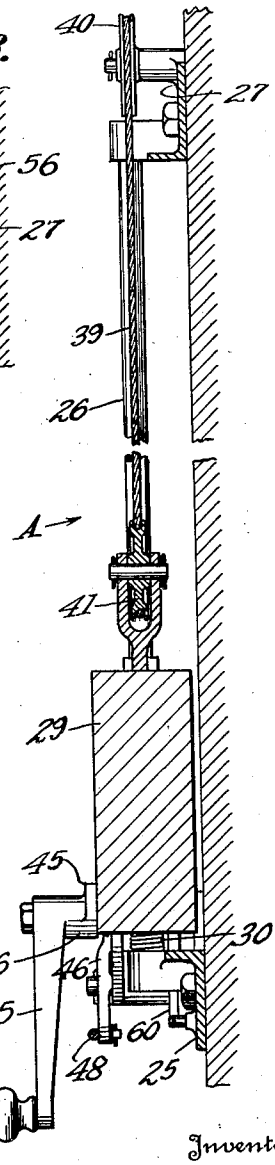


Fig. 3.

Fig. 4.

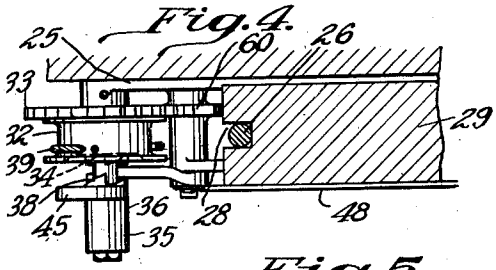
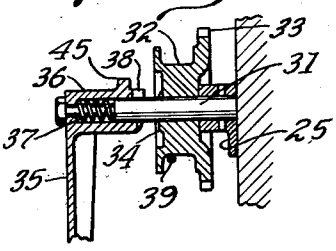


Fig. 5.



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Fig. 6.

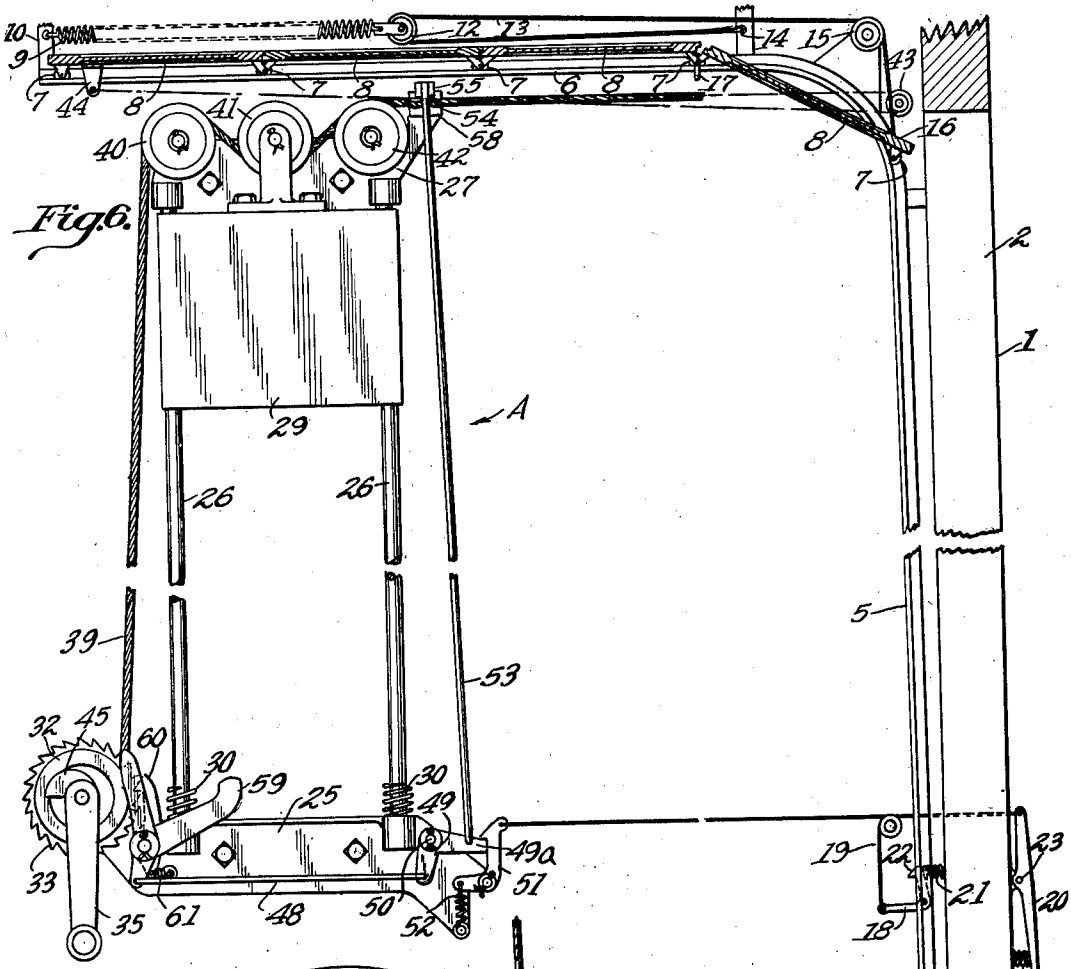
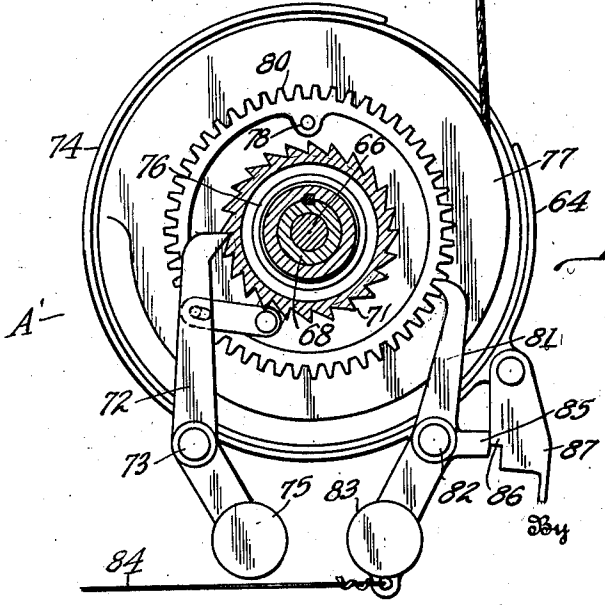


Fig. 9.



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Fig. 7.

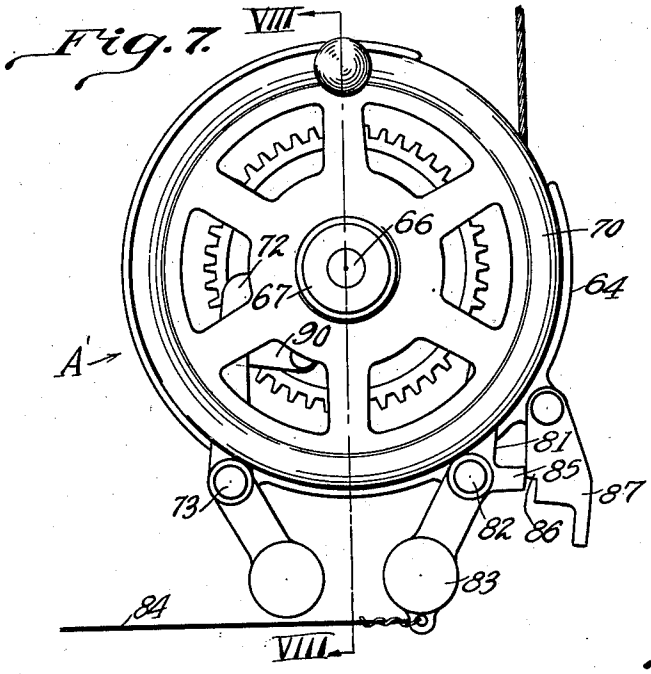


Fig. 11.

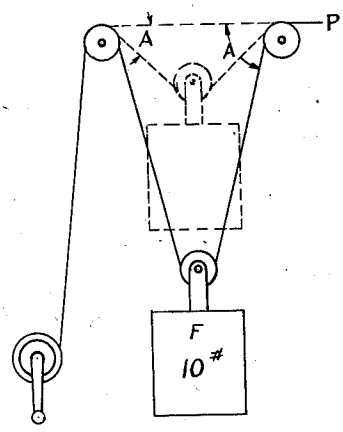


Fig. 8.

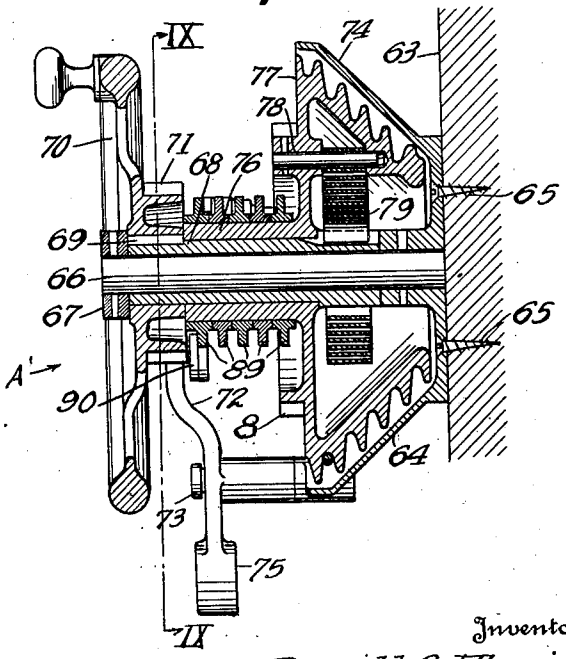
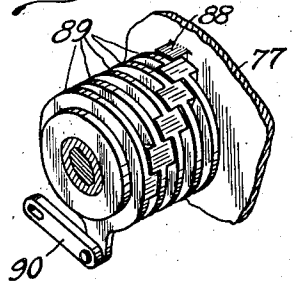


Fig. 10.



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UNITED STATES PATENT OFFICE

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DOOR OPERATING MECHANISM

Burritt G. Fleming, Columbus, Ohio

Application March 22, 1934, Serial No. 716,828

4 Claims. (Cl. 268—58)

This invention relates to improvements in door actuating mechanism and has particular reference to the actuating mechanism of doors of the rolling, tilting or swinging types used for the opening and closing of doorways provided in connection with garages, warehouses, stores and other buildings.

In the operation of the vertically movable rolling type of door, which is widely used in the construction of garages and the like, a door structure is provided consisting of a plurality of hingedly connected sections supported in connection with stationary guides and arranged when in a lowered position to close an associated doorway and when in an elevated position to lie in a substantially horizontal plane parallel with and, ordinarily, closely adjacent to the ceiling of the garage, or other room. Usually these doors are connected with counter-balancing springs which permit of the use of but slight manual pressure or forces in moving the door from one position to another. However, it is quite often necessary in the operation of this type of door to stand in a position of exposure to the elements in the act of opening or closing the same. To eliminate this condition, it has been proposed to employ electric motors and associated electrical circuits and switch mechanism to admit of the automatic opening and closing of garage doors of this character without requiring a vehicle operator to leave his position in a motor vehicle to effect the actuation of the doors. Such automatic mechanism is quite desirable for obvious reasons over the ordinary hand controlled method but possesses the disadvantage of being quite costly and likely to become out of order and to be the source of a very considerable amount of mechanical or electrical disorder so that such control mechanism has not been widely used, except in public or commercial garages.

It is therefore, one of the outstanding objects of the present invention to provide simple and positive mechanical means whioh are adapted to be employed in cooperation with a movable door by which the door may be opened or closed from the exterior of the building, such as a garage, without requiring the vehicle operator to leave his position within the vehicle to effect such door actuation, the door operating mechanism being purely mechanical and devoid of electrical circuits or other delicate means which are apt to become out of order and occasion frequent repair and adjustment.

In accordance with the present invention, I provide a door which is mounted for movement between positions of doorway opening and closure and associate therewith an operating means to move the door automatically to its position of doorway opening. In connection with this mechanism, the invention also comprehends the provision of an actuating unit and mechanically operated means for placing said unit in a restrained state of potential energy which is adequate to restore said door, when released, to its position of closure against the resistance offered by the automatic door opening means, the restraining means functioning upon proper operation for releasing the energy of said unit to cause the latter to move the door to its position of closure.

With these and other objects in view, which will appear as the description proceeds, the invention consists in the novel features of construction, combination of elements and arrangements of parts hereinafter described and pointed out in the appended claims.

In said drawings:

Fig. 1 is a view in side elevation of the weight controlled type of actuating unit for closing an associated movable door of the automatically openable type;

Fig. 2 is a vertical sectional view, the plane of the figure being illustrated by the line II—II of Fig. 1;

Fig. 3 is a detail vertical sectional view of the cable gripping means used in connection with the actuating unit, the plane of the view being indicated by the line III—III of Fig. 1;

Fig. 4 is a detail transverse horizontal sectional view taken on the line IV—IV of Fig. 1;

Fig. 5 is a vertical sectional view on the line V—V of Fig. 1;

Fig. 6 is a vertical sectional view taken through a doorway and an associated automatically openable door mechanism and disclosing the semi-automatic actuating unit comprising the present invention in association therewith, the weight of the actuating unit being disclosed in its elevated position and operable when released to effect the closing of the door;

Fig. 7 is a view in side elevation of a modified form of semi-automatic door actuating unit of the spring type;

Fig. 8 is a vertical sectional view on the line VIII—VIII of Fig. 7;

Fig. 9 is a transverse vertical sectional view taken on the line IX—IX of Fig. 8;

Fig. 10 is a detail perspective view of the per-

mutational trip rings employed in the spring type actuating unit.

Fig. 11 is a sketch of the mechanism of Fig. 1.

Referring more particularly to the drawings and especially to the form of the invention illustrated in Figs. 1 to 6 inclusive, the numeral 1 designates the exterior wall of a building such as a garage or the like, the numeral 2 indicates the doorway formed in said wall and 3 the floor surface of the building or garage. The doorway is adapted to be opened or closed by means of a movable door structure 4. For convenience in description and illustration, this door structure has been shown as comprising the so-called "overhead" type, although it will be understood that the invention is applicable to other types of doors which are weighted or spring actuated to facilitate their opening and closing, and I therefore do not limit myself to the particular door structure illustrated and hereinafter described.

This door structure shown, comprises a pair of stationary angle guides which are formed to include substantially vertical portions 5 and substantially horizontal portions 6, the latter being preferably arranged in a horizontal plane immediately above that of the upper portion of the doorway 2. Cooperative with these guides are rollers 7, which are carried by the hingedly connected sections 8 of the rolling door structure, whereby when the door structure is opened to provide free ingress or egress through the doorway 2, the horizontal upper portions of said guides support the door structure, as disclosed in Fig. 6, and when the door structure is lowered, the vertical portions 5 of said angular guides serve to maintain the various sections of the door structure in close engagement with the door jamb.

To effect the automatic opening of a door of this character, use is made of one or more springs 9. More tension is put in these springs than is necessary to balance the door, so that the latter will open when released. In this instance, the spring 9 has been shown as connected with a frame member 10 formed in connection with one end of the horizontal portion 6 of an angular door guide, while the other end of said spring is connected with a clevis 11 which carries a roller 12. Passing around the roller 12 is a cable 13, which is fastened as at 14 at one end to a stationary attaching member, while the other portion of the cable, after passing around the roller 12 is trained over a guide 15 and is secured as at 16 to the lowermost door section. To retain the door structure in its lowered or closed position, the said door structure is provided with one or more lugs 17 which are arranged to cooperate with one or more pivoted keepers 18 in the form of bell crank levers. These levers, forming a restraining means, are connected by means of a cable or cables 19 with a pivoted member 20 mounted in connection with the outer portion of the wall 1. Springs 21 cooperate with the keepers 18 to maintain their hooked extremities 22 in positions to engage with the lug or lugs 17. The member 20 is pivoted as at 23 in connection with the wall 1 and its lower portion is normally pressed outwardly by a spring or its equivalent as shown at 24. With the door in its lowered position, the lug or lugs 17 engage with the hooked extremity 22 of the keeper or keepers 18, thereby retaining the door in a lowered position against the influence of the spring or springs 9. However, when the member 20 is moved about its pivotal axis, for instance by contacting the bumper of a motor vehicle with the lower portion of said member, the cable or cables 19 will be operated to retract the keeper or keepers 18 to provide for the automatic elevation of the door structure to its open position as disclosed in Fig. 6, providing for the opening of the doorway 2 for the passage therethrough of a motor vehicle. This provides a simple yet efficient mechanical arrangement for providing for the automatic opening of a folding or rolling door structure without requiring the operator of the motor vehicle to first leave the vehicle and to be exposed to the weather in order to open the door structure.

After the vehicle enters the garage and the operator leaves said vehicle, the door structure may be closed by its manual manipulation. In this instance, however, the operator may stand within the garage and thus be protected from the weather. In most instances, the operator is obliged to leave his vehicle after entering the building and therefore this door closing operation does not entail any particular inconvenience on the operator's part. By reason of the counter-balancing springs 9, this closing operation may be readily carried out without any particular manual exertion which is merely sufficient to overcome the over-balancing energy in the springs or weights, as disclosed at 9. When it is desired to open the door structure to drive the motor vehicle out of the garage, it is merely necessary to actuate the keepers 18 to release the door structure and thereby effect its automatic opening. However, after this is done and the vehicle is driven out of the garage through the open doorway, the present invention provides a mechanical actuating unit of a semi-automatic nature for closing the door structure without requiring the vehicle operator to leave his driving position within the vehicle.

This actuating unit is designated in its entirety by the reference character A, and in the form of the invention depicted in Figs. 1 to 6 inclusive, the said unit comprises a wall-supported frame consisting of a base casting 25, spaced upstanding rods 26 and a transversely extending upper casting 27 which is rigidly secured to the upper ends of the rods 26. The rods 26 are positioned in vertical grooves 28 provided in the vertical edges of a weight 29, which is mounted for limited vertical movement in connection with the guides, the descent of the weight 29 being yieldingly checked by coil springs 30 which surround the lower portions of the rods 26. Carried by the base casting 25 is a stationary transversely extending stud shaft 31 upon which is loosely mounted for rotation a drum 32 provided with peripheral ratchet teeth 33 and on its outer side with a clutch face 34.

A hand crank 35 is rotatably supported by the outer end of the shaft 31 and is formed with a hollow hub 36 in which is positioned a coil spring 37 which normally tends to force the crank 35 outwardly with respect to the stud shaft 31. The inner surface of the hub 36 is formed with a clutch face 38 which is adapted to engage with the clutch face 34 of the drum 32 when the crank is pressed inwardly by a manual operation against the resistance offered by the spring 37, so that the drum 32 may be rotated through the manual turning of the crank 35.

Connected with the drum 32 is one end of a cable 39. This cable passes around the drum and is trained upwardly to pass over a sheave 40 rotatably mounted in connection with the top casting 27. After passing over the sheave 40, the cable 39 extends downwardly and is trained

around and under a sheave 41 rotatably carried by the upper portion of the weight member 29. From the sheave 41, the cable 39 is trained upwardly and passes over a second sheave 42 carried by the top casting 27. As shown more particularly in Fig. 6, the cable 39, after passing around the sheave 42, is trained forwardly and passes around a guide pulley 43 stationarily mounted in connection with the door structure guides and after passing around the pulley 43, the cable 39 is directed to and secured with a fixed bracket 44 carried by the upper section of the door structure.

By this arrangement, in order to close the door structure automatically, the driver of a motor vehicle preparatory to leaving the garage first rotates the drum 32 to raise the weight member 29 from its lowered position shown in Fig. 1 to its elevated position disclosed in Fig. 6. When the crank 35 is first rotated, after the engagement of the clutch faces 34 and 38, a cam 45, formed in connection with the crank 35, contacts with an arm 46 which is pivotally mounted in connection with the base casting 25 as at 47. The arm 46 is connected by a rod 48 with a bell crank lever 49 which, in turn, is pivoted as at 50 on the casting 25. The rocking of the arm 46 by the cam 45 results in the oscillation of the lever 49 to pull the arm 49a thereof downwardly so that the arm 49a may be held in its lowered position by means of a pivoted latch 51, spring actuated as at 52. The downward movement of the arm 49a is applied to a vertical rod 53 which has its upper end pivotally connected as at 54 with a brake lever 55. This brake lever is pivotally mounted as at 56 in connection with the top casting 27 and is normally forced upwardly by an associated spring 57. The cable 39 passes between the lever 55 and a fixed shelf 58 formed in connection with the casting 27. Thus when the rod 53 is forced downwardly, the lever 55 is brought into frictional engagement with the cable 39 to frictionally clamp the latter in connection with the upper casting to hold this portion of the cable against movement.

It will be seen that with the cable 39 clamped by the brake lever 55, the rotation of the drum will result in the elevation of the weight member 29 to the position disclosed in Fig. 6. Engaging with the under surface of the weight member when the latter is in its lowered position is a crank arm 59 which has its hub loosely mounted for rocking movement on the shaft 47. Formed with this hub is a pawl 60, which is arranged in registration with the ratchet teeth 33 provided on the drum 32, the crank arm 59 being spring actuated as at 61. When the weight member is in its lowered position as diclosed in Fig. 1, its engagement with the crank arm 59 moves the pawl 60 to a position out of engagement with the ratchet teeth 33. However, as soon as the weight member is elevated to an extent sufficient to clear the crank arm 59, the spring 61 associated with the latter moves the pawl 60 into contact with the ratchet teeth 33 to hold the drum 32 against rotation in a direction which would permit of the lowering of the weight member. Following the raising of the weight member, which can be easily accomplished by a few simple turns of the hand crank 35, the vehicle may be driven out of the garage through the open doorway. Then, in order to close the door structure without requiring the operator to leave the vehicle, it is merely necessary to engage the member 20 by contacting the latter with the bumper of the vehicle so that said member may be rocked sufficiently to pull a cable 62 which is connected with the latch 51. This rocks the latch about its axis and releases the bell crank lever 49 so that the brake lever 55 will be released from frictional contact with the cable 39. Inasmuch as the sheave wheels 40, 41 and 42 are in a position of approximate horizontal registration, as shown in Fig. 6, the full force and leverage of the weight member is then made available to act on the cable 39 to apply a pulling effort thereto which is of sufficient magnitude to overcome the inertia of the door structure and its associated counter-balancing springs, so that said door structure will be drawn to its closed or lowermost position. The increased energy applied to the cable is due to the toggle joint effect applied by the weight when the weight is in its uppermost and releasing position, as shown by the following table and diagram in Fig. 11.

Angle "A"	Weight F.	Pull on cable P.
Degrees	*Pounds*	*Pounds*
4	10	72
5	10	57
6	10	47
7	10	40
8	10	36
9	10	31.5
10	10	28.4
11	10	25.7
12	10	23.5
13	10	21.7
14	10	20.0
15	10	18.7
16	10	17.4
17	10	16.4
18	10	15.4
19	10	14.5
20	10	13.7

It will be noted by virtue of this system of door control that both the opening and closing of the door may be effected from the exterior of the building by merely bringing the bumper of the motor vehicle into contact with the pivoted member 20. Furthermore, the control operation is purely mechanical and is devoid of fine delicate parts which are apt to become out of order or to occasion frequent adjustment and repair. While the door controlling mechanism is not fully automatic but, in effect, semi-automatic, yet all of the manual operations may be performed from within the garage building where the operator is protected and subjected to no particular inconvenience.

In lieu of the weight controlled actuating unit, shown in Figs. 1 to 6, I may employ a more compact unit of the spring actuated type as illustrated in Figs. 7 to 10. In this form of my invention, the spring unit A' is mounted in connection with a wall 63 of a garage building and includes a base casting 64, which is screwed or otherwise secured as at 65 to the wall 63. Fixed to the hub of the casting 64 is a horizontally disposed outwardly extending stud shaft 66 to the outer end of which is connected a head collar 67. Mounted for rotation on the shaft 66 is a sleeve 68 which has its outer end splined as at 69 to a hand operated rotated wheel 70. The hub of this wheel is provided with ratchet teeth 71 which cooperate with a pawl 72 pivotally mounted as at 73 in connection with the conical shell portion 74 of the casting 64. A pawl 72 holds the spring against counter-rotation until the door is completely closed, then the pawl is automatically released. The lower end of the pawl 72 below its pivotal point 73 is weighted as at 75 and therefore the balance of the pawl is

such as to maintain its upper portion normally in contact with the ratchet teeth 71.

Loosely mounted for rotation around the sleeve 68 is the tubular hub extension 76 of a grooved cable drum 77, which is mainly disposed within the conical portion of the shell 74. For doors where there is a constant load throughout the path of the door opening and closing, a weight is generally required, therefore to overcome this weight, a constant source of energy is required from the closing spring. As the spring loses its energy as it unwinds, a conical drum with the increments of the groove diameters proportional to the reduction of spring energy will be required. The drum 77 is provided with a pin 78 to which is secured the outer end of a clock spring 79, the inner end of said spring being secured to the inner portion of the sleeve 68. The outer vertical wall of the drum 77 is provided with ratchet teeth 80 which engage the upper hooked extremity of a pawl 81. This pawl is pivoted as at 82 in connection with the shell 74 and its lower portion is weighted as at 83 so that the normal tendency of the pawl is to maintain engagement between its hook shaped upper end, and the teeth 80, thus holding the cable drum 77 against rotation. The cable 39 is secured at one end to the grooves provided in the periphery of drum 77 and is adapted to pass over guides 43 for association with the bracket 44 as in the previously described form of invention.

In the operation of this type of spring actuator, the hand wheel 70 is rotated which revolves the sleeve 68 and winds the spring 79 to a compressed or taut condition, the drum 77 being held against movement during this winding operation by the pawl 81. To release the pawl, the latter may be tripped by means of a cable 84 which is connected with the member 20. The actuation of the member 20 by the bumper of the motor vehicle withdraws the hooked end of the pawl 81 from engagement with the drum teeth 80, permitting said drum to rotate under the energy of the spring 79 so that the cable 39 is wound thereabout for the purpose of drawing the associated door structure to its position of closure. To provide for the unrestricted rotation of the drum when so released or tripped, the pawl 81 is formed with a crank lug 85 which is arranged for engagement with a shoulder 86 provided on a pivoted latch 87 carried by the shell 74, the latch 87 responds gravitationally to hold the pawl 81 out of engagement with the teeth 80.

The rotation of the cable drum causes a lug 88 formed in connection with its outer vertical wall to engage with a corresponding lug provided on one of a plurality of similarly formed permutation rings 89 which are loosely mounted for rotation on the hub of the cable drum. Following predetermined rotation of the cable drum, the outer or last of these rings will rotate in unison with the drum. The outer of the rings 89 is connected by means of a link 90 with the pawl 72 so that the latter will be actuated to release its engagement with the teeth of the ratchet wheel 71, so that the drum 77 may be freely rotated to permit of the raising and lowering of the associated door structure when the actuating unit A' is inactive,

What is claimed is:

1. In door operating mechanism, a door movable between positions of doorway opening and closure, a releasable device for retaining said door in its position of closure, means connected with said door and operable upon the release of said device to move said door automatically to its position of doorway opening, door closing means including a drum, a cable connected at one end with said drum and at its other end with said door, a pair of spaced guides around which the intermediate portion of said cable is trained, a vertically movable weight member provided with a guide for engagement with said cable between said spaced guides, means operable upon the rotation of said drum to clamp the intermediate portion of said cable against longitudinal movement whereby to effect the elevation of said weight member and to retain said weight member in its elevated position, and remotely controlled release means for releasing said weight member, drum rotation and cable clamping means, whereby to utilize the descent of said weight member through said cable to effect the closing of the door.

2. In door operating mechanism, a door composed of a plurality of hinge united sections movable between positions of doorway opening and closure, guides in which said door sections are mounted for movement in substantially vertical and horizontal planes, a releasable device for retaining said door in its position of closure, means connected with said door and operable upon the release of said device to move said door automatically to its position of doorway opening, door closing means including a drum, a cable connected at one end with said drum and at its other end with said door, a pair of spaced guides around which the intermediate portion of said cable is trained, a vertically movable weight member provided with a guide for engagement with said cable between said spaced guides, means operable upon the rotation of said drum to clamp the intermediate portion of said cable against longitudinal movement whereby to effect the elevation of said weight member and to retain said weight member in its elevated position, and remotely controlled means for releasing said weight member, drum rotation and cable clamping means, whereby to utilize the gravitational descent of said weight member through said cable to effect the closing of the door.

3. In apparatus of the character set forth, the combination with a vertical wall having a doorway formed therein, of a door composed of a plurality of hinge united sections movable between positions of doorway opening and closure, guides in which said door sections are mounted for movement in substantially vertical and horizontal planes, a latch mounted internally of said doorway for normally maintaining said door in its position of doorway closure, door opening means counteracting the weight of said door and operable upon release of said latch to move said door automatically to its substantially horizontal position of doorway opening, manually set means operable upon the actuation of said latch when said door is in its open position to move the door to its position of doorway closure against the influence of the door opening means, and a movable member permanently and directly mounted on the exterior of said vertical wall in a position to be engaged by the bumper of a motor vehicle to effect the actuation of said latch.

4. In apparatus of the character described, the combination with a vertical wall having a doorway formed therein, of a door movably mounted to open and close said doorway, means counteracting the weight of said door for moving the latter automatically to its position of doorway

opening, manually set means for automatically moving said door to its position of doorway closure, latch mechanism mounted internally of said doorway for maintaining said door in its position of closure against the influence of the door opening means, release mechanism within said doorway for controlling the operation of the door closing means, a movable actuating member mounted exteriorly of said doorway on said wall above the ground level for engagement with the bumper of a motor vehicle, and operating connections between said member, said latch and said release mechanism.

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